CHROMOSOME NUMBERS IN THE GENUS *NASSAUVIA* (COMPOSITAE–MUTISIEAE)[1]

J. H. Hunziker,[2,3] *A. F. Wulff,*[3]
T. F. Stuessy,[4] *D. J. Crawford,*[4] *and*
J. V. Crisci[5]

ABSTRACT

Meiotic chromosome numbers were determined ($n = 11$ and ca. 44; $x = 11$) and observations made for eight species of *Nassauvia* (Compositae, Mutisieae). The numbers include counts for seven species that have not previously been investigated cytologically: *N. axillaris*, *N. chubutensis*, *N. glomerulosa*, *N. lagascae*, *N. revoluta*, and *N. uniflora* (all with $n = 11$) and *N. aculeata* (with $n =$ ca. 44). The results reveal three known chromosomal levels for the genus: $n = 11$ ($2x$), $n = 22$ ($4x$), and $n =$ ca. 44 ($8x$). Infraspecific polyploidy in *Nassauvia* is known in *N. magellanica* with both $n = 11$ and 22. The closest generic relatives are *Calopappus* and *Triptilion*, but no cytological data are yet available for them. The most closely related genus for which chromosomal data are available is *Moscharia* with $n = 20$, which suggests that it and *Nassauvia* could be based on $x = 11$ (or perhaps $x = 10$).

The genus *Nassauvia* Comm. ex A. L. Juss. of the Compositae belongs to the tribe Mutisieae, subtribe Nassauviinae. It comprises 38 species (Cabrera, 1982; Arroyo & Marticorena, 1988) distributed from southern Bolivia along the Andes to southern Patagonia, Tierra del Fuego, and the Malvinas (Falkland) Islands. The genus demonstrates a trend toward reduction of numbers of flowers in each capitulum and aggregation of capitula into secondary inflorescences, or pseudocephalia.

The cytology of this genus has been poorly studied. Chromosome numbers are known only from four (10%) of the species. The following numbers have already been documented: $n = 11$ for *N. darwinii*, *N. magellanica*, and *N. serpens*; and $n = 22$ for *N. gaudichaudii* and *N. magellanica* (Moore, 1967, 1981; Crisci, 1974b; Cabrera, 1982). The present study presents chromosomal data for additional species of the genus and comments on their systematic and evolutionary significance.

MATERIALS AND METHODS

Meiotic investigations were made from young inflorescences fixed in modified Carnoy's solution (4 : 3 : 1, chloroform : ethanol : acetic acid) or modified Newcomer's solution (Hunziker, 1966). The latter proved superior. Root tips were squashed in 45% propionic acid haematoxylin (2%) with ferric citrate (1%) used as mordant (Saez, 1960; Nuñez, 1968). Preparations were mounted in Euparal after removal of the coverslip by freezing with carbon dioxide. Voucher specimens are deposited at LP. The sources of the materials collected in Argentina are presented in Table 1.

RESULTS AND DISCUSSION

In the diploid species (*N. axillaris*, *N. chubutensis*, *N. darwinii*, *N. glomerulosa*, *N. lagascae*, *N. revoluta*, and *N. uniflora*) meiosis was regular with $2n = 11II$ (Fig. 1A, C–H). In contrast, *N. aculeata* (Fig. 1B) was found to be octoploid with $2n =$ ca. 44 bivalents. Except for *N. darwinii*, all of these species are reported here for the first time. With these new counts, 11 species (29%) of *Nassauvia*, including species from each section, have been analyzed cytologically. The basic number is clearly $x = 11$, with three ploidy levels: $2x$, $4x$, and $8x$. This basic number is also known in other genera of the Nassauviinae, e.g., *Holocheilus* Cass.

---

[1] Appreciation is expressed to: CONICET for financial support to JHH and JVC; the National Science Foundation (Grant INT-8402888) to TFS and DJC; M. Gentile for help in field investigations; and M. M. Cigilano, P. Gentile, J. Moreno, and J. Zech for additional assistance in field studies. JHH and JVC belong to the Carrera del Investigador Científico, and AFW to the Personal de Apoyo a la Investigación Científica (CONICET).

[2] Instituto de Botánica Darwinion, C. C. 22, San Isidro 1642, Argentina.
[3] Facultad de Ciéncias Exactas y Naturales, Universidad de Buenos Aires, 1428 Buenos Aires, Argentina.
[4] Department of Plant Biology, The Ohio State University, Columbus, Ohio 43210, U.S.A.
[5] División Plantas Vasculares, Museo de La Plata, 1900 La Plata, Argentina.

ANN. MISSOURI BOT. GARD. 78: 512–515. 1991.

TABLE 1. New chromosome counts of species of *Nassauvia*. Vouchers on deposit at LP, OS, and SI.

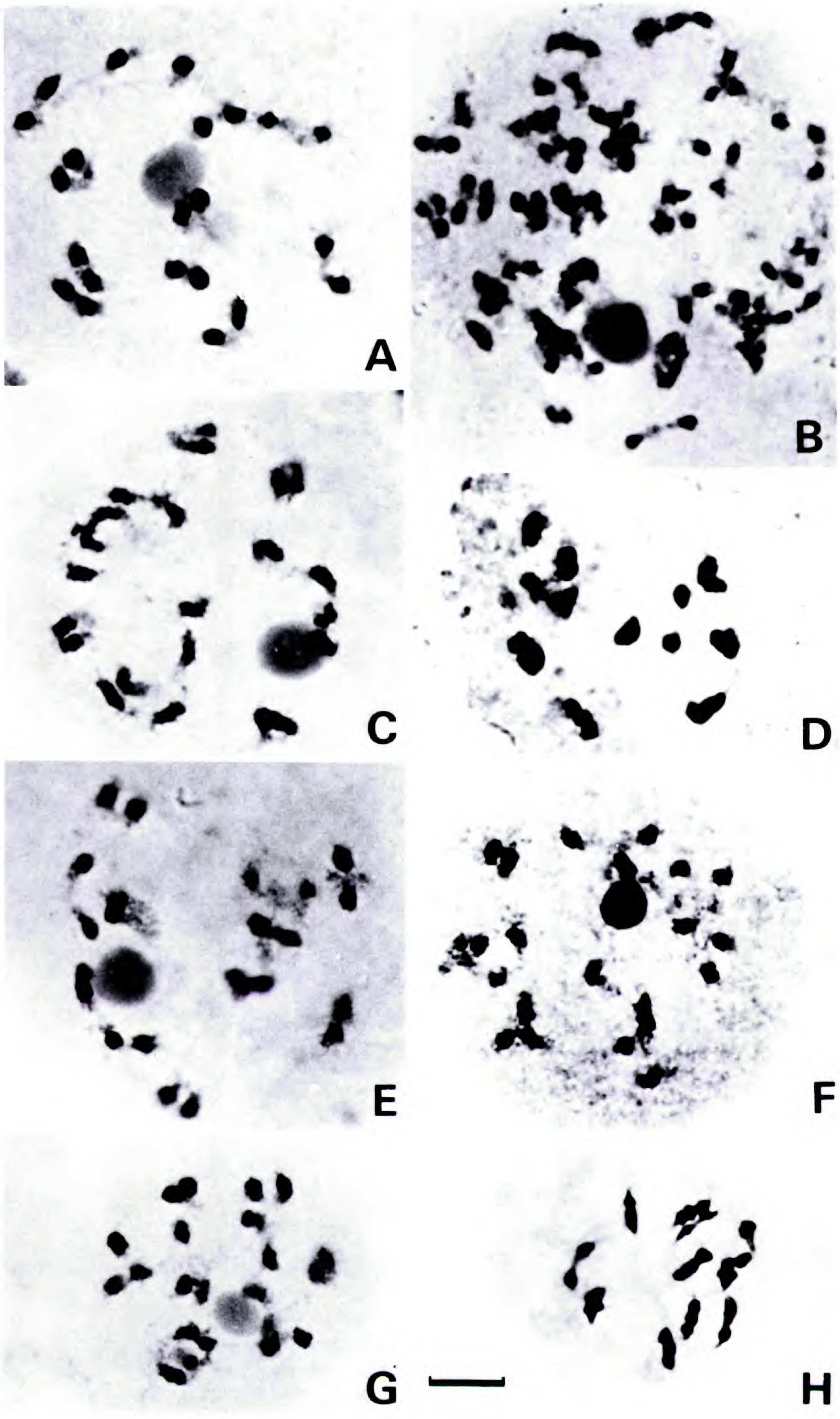
Taxon	Chromosome count	Number of cells studied	Location and voucher[1]
N. aculeata (Less.) Poeppig var. *robusta* (Cabrera) Cabrera	n = ca. 44	3	Prov. Chubut, Dep. Futaleufú, 45 km SE de Esquel, sobre ruta 40, hacia Tecka, 4 Dec. 1984, *TFS, DJC, JVC, MMC & MG 6842*
N. axillaris (Lagasca) D. Don	$n = 11$	3	Prov. Chubut, Dep. Languiñeo, 37 km al E de Tecka, ruta prov. 63 hacia Quichaura, 6 Dec. 1984, *TFS, DJC, JVC, MMC & MG 6868*
N. chubutensis Speg.	$n = 11$	6	Prov. Chubut, Dep. Mártires, 9 km al S de Las Chapas (ruta 31), 8 Dec. 1984, *TFS, DJC, JVC, MMC & MG 6946*
N. darwinii (J. D. Hook. & Arn.) O. Hoffm. & Dusén	$n = 11$	24	Prov. Chubut, Dep. Languiñeo, ca. 6.5 km E de Lago Vinter, 7 Dec. 1984, *TFS, DJC, JVC, MMC & MG 6894*
N. glomerulosa (Lagasca) D. Don	$n = 11$	18	Prov. Chubut, Dep. Languiñeo, 10 km E de Tecka, ruta hacia Quichaura, 6 Dec. 1984, *TRS, DJC, JVC, MMC & MG 6863*
N. lagascae (D. Don) F. Meigen	$n = 11$	12	Prov. Mendoza, Dep. San Carlos, Borde SW de Laguna Diamante, 3,370 m, 27 Jan. 1985, *JHH, AFW & NGG 11326*
N. revoluta D. Don	$n = 11$	7	Prov. Chubut, Dep. Futaleufú, Cerro La Hoya, 15 km NE de Esquel, 5 Dec. 1984, *TFS, DJC, JVC, MMC & MG 6857*
N. uniflora (D. Don) Hauman	$n = 11$	15	Prov. Mendoza, Dep. Las Heras, alrededores Laguna Los Horcones, 3,180 m, 16 Jan. 1985, *JHH, AFW & NGG 11163*
N. uniflora (D. Don) Hauman	$n = 11$	24	Prov. Mendoza, Dep. Las Heras, Laguna Los Horcones, 3,050 m, 17 Jan. 1985, *JHH, AFW & NGG 11183* [Fig. 1A]
N. uniflora (D. Don) Hauman	$n = 11$	4	Prov. Mendoza, Dep. Las Heras, Playa Ancha, Quebrada del Tolosa, 3,660 m, 18 Jan. 1985, *JHH, AFW & NGG 11195*
N. uniflora (D. Don) Hauman	$n = 11$	2	Prov. Mendoza, Dep. Luján, Las Cuevas, 3,160 m, 19 Jan. 1985, *JHH, AFW & NGG 11205*

[1] JHH, AFW, and NGG = J. H. Hunziker, A. F. Wulff, and N. G. Galiano; TFS, DJC, JVC, MMC, and MG = T. F. Stuessy, D. J. Crawford, J. V. Crisci, M. M. Cigliano, and M. Gentile.

($n = 11$; Coleman, 1968; also reported with $n = 18$, Crisci, 1976) and *Marticorenia* Crisci ($n = 22$; Crisci, 1974a). However, these two genera are not included in the same evolutionary cluster in the phylogenetic reconstructions of the subtribe by Crisci (1974b, 1980).

Although most of the species of *Nassauvia* are diploids, three polyploids are known. *Nassauvia aculeata* is n = ca. 44 (octoploid). The other counted species of sect. *Panargyrum* are diploid ($n = 11$; *N. darwinii* and *N. uniflora*). The chromosomes of *N. aculeata* are smaller than those of the diploids, a relationship also observed in other groups (Darlington, 1963; Grant, 1976). This could be due to (1) smaller chromosome size in diploid progenitors, or (2) chromosome size reduction after the ploidy jump occurred (e.g., Poggio & Hunziker, 1986). Of all the species of *Nassauvia*, *N. aculeata* is particularly variable morphologically and has a wide geographic distribution. Taxonomically this has resulted in the recognition of three varieties (Cabrera, 1982). The wide range of *N. aculeata* may be due at least in part to its polyploid condition and genetic diversity. More populational sampling is needed to determine if infraspecific chromosomal races are present, such as documented in *N. magellanica* J. Gmelin (see below) and as known in other members of the family (e.g., in *Melampodium* L.; Stuessy, 1971).

The second polyploid in *Nassauvia* is *N. gaudichaudii*, a tetraploid with $n = 22$. The five other species of this section, *N. ameghinoi* Speg., *N.*


A
B
C
D
E
F
G
H

hillii, *N. juniperina* Skottsb., *N. pentacaenoides*, and *N. pygmaea* (Cass.) J. D. Hook, are unknown chromosomally. Material of *N. hillii* and *N. juniperina* was attempted without success.

The third case of polyploidy in *Nassauvia* is *N. magellanica* in which both $n = 11$ (Moore in Crisci, 1974b) and $n = 22$ (Moore, 1981) have been recorded. This infraspecific polyploidy occurs in a taxon of the relatively advanced sect. *Nassauvia*, which contains species with high degrees of head condensation.

Within the subtribe Nassauviinae, *Nassauvia* is closest both phenetically and cladistically to *Triptilion* Ruíz Lopez & Pavón and *Calopappus* Meyen (Crisci, 1974b, 1980; Crisci & Freire, 1986). As chromosome counts are not yet available for these two genera, however, the generic relationships cannot be assessed cytologically. The next closest relatives of *Nassauvia* are probably *Polyachyrus* Lagasca and *Moscharia* Ruíz Lopez & Pavón (Crisci, 1974b, 1980), and the latter has $n = 20$ (Crisci, 1974b). This suggests a base number of $x = 10$ or 11 for the ancestral stock of these genera and that *Moscharia* is probably polyploid. Other more distant relatives might include *Panphalea* ($n = 8$), *Holocheilus* ($n = 11$ and 18), and *Perezia* ($n = 4, 8, 12$), but the relationships of these genera are uncertain and differ depending upon the phenetic or cladistic algorithm used. Other recorded chromosome numbers in the subtribe (summarized in Crisci, 1974b) are $n = 27$ in *Acourtia* D. Don, $n = 18$ in *Jungia* L. f., $n = 22$ for *Marticorenia*, and $n = 27$ for *Proustia* Lagasca and *Trixis* P. Browne.

For insights on evolution within *Nassauvia*, the most likely outgroup of *Nassauvia* seems to be *Calopappus*, which possesses large single capitula (Crisci & Freire, 1986). The other closely related genus, *Triptilion*, seems best regarded as having evolved from *Nassauvia*. *Triptilion* has different aggregations of heads, but most are moderately clustered in the axils of the leaves. We regard this as perhaps having come from sect. *Panargyrum* of *Nassauvia*, which has similar levels of intermediate head aggregation. The most primitive section of *Nassauvia* is probably *Mastigophora*, particularly *N. pentacaenoides* Speg., which resembles *Calopappus* in head aggregation, leaf arrangement, and rhizomatous habit.

LITERATURE CITED

ARROYO, M. T. K. & C. MARTICORENA. 1988. A new species of the South American genus *Nassauvia* (Compositae: Mutisieae) from Chilean Patagonia. Brittonia 40: 332–334.

CABRERA, A. L. 1982. Revisión del género *Nassauvia* (Compositae). Darwiniana 24: 283–379.

COLEMAN, J. R. 1968. Chromosome numbers in some Brazilian Compositae. Rhodora 70: 228–240.

CRISCI, J. V. 1974a. *Marticorenia*: a new genus of Mutisieae (Compositae). J. Arnold Arbor. 55: 38–45.

———. 1974b. A numerical-taxonomic study of the subtribe Nassauviinae (Compositae, Mutisieae). J. Arnold Arbor. 55: 568–610.

———. 1976. Números cromosómicos en los géneros *Panphalea* y *Holocheilus* (Compositae, Mutisieae). Hickenia 1: 17–20.

———. 1980. Evolution in the subtribe Nassauviinae (Compositae, Mutisieae): a phylogenetic reconstruction. Taxon 29: 213–224.

——— & S. E. FREIRE. 1986. El género *Calopappus* (Compositae, Mutisieae). Caldasia 15: 57–69.

DARLINGTON, C. D. 1963. Chromosome Botany and the Origin of Cultivated Plants. G. Allen & Unwin Ltd., London.

GRANT, W. F. 1976. The evolution of karyotype and polyploidy in arboreal plants. Taxon 25: 75–84.

HUNZIKER, J. H. 1966. Números cromosómicos y cariotipos de varias especies sudamericanas de *Agropyron* y *Elymus* (Gramineae). Kurtziana 3: 151–156.

MOORE, D. M. 1967. Chromosome numbers of Falkland Islands angiosperms. Brit. Antarct. Surv. Bull. 14: 69–82.

———. 1981. Chromosome numbers of fuegian angiosperms. Bol. Soc. Brot., ser. 2, 53: 995–1012.

NUÑEZ, O. 1968. An acetic-haematoxylin squash method for small chromosomes. Caryologia 21: 115–119.

POGGIO, L. & J. H. HUNZIKER. 1986. Nuclear DNA content variation in *Bulnesia*. Heredity 77: 43–48.

SAEZ, F. A. 1960. El empleo de la hematoxilina acética o propiónica para el estudio de los cromosomas con la técnica del aplastamiento. Comun. Soc. Biol. Montevideo. [Mimeographed.]

STUESSY, T. F. 1971. Systematic relationships in the white-rayed species of *Melampodium* (Compositae). Brittonia 23: 177–190.

←

FIGURE 1. Meiotic chromosomes of species of *Nassauvia*. —A. *N. uniflora*. —B. *N. aculeata*. —C. *N. revoluta*. —D. *N. axillaris*. —E. *N. darwinii*. —F. *N. chubutensis*. —G. *N. lagascae*. —H. *N. glomerulosa*. All same scale. A–G = diakinesis, H. = prometaphase I.